**Listed Waterbody:** **San Lorenzo River**

**Listed Condition:** **Nitrate**

**Progress Report:** **Implementation Tracking**

This progress report reflects the status of this project at the end of fiscal year 2005 (FY 04-05). On May 19th 2000, the Regional Board adopted Resolution No. 00-001 including the San Lorenzo River (including Carbonera Creek, Lompico Creek, and Shingle Mill Creek) Nutrient Total Maximum Daily Load (TMDL) as a Basin Plan Amendment. The TMDL was effective on January 14th, 2003 when it was approved by USEPA.

**Background:**

The San Lorenzo River Nitrate TMDL implementation relies on actions identified in the Nitrate Management Plan. Implementation of the recommended actions was projected to provide for a 15-20% reduction in nitrate levels over 10 years following TMDL adoption, with a further reduction of 10% in the next 10 years. The TMDL identifies the maximum pollutant contributions allowed to attain water quality standards and specifies a target attainment year of 2005 for nitrate levels to be reduced by 15%. The TMDL also requires the County to report on the following activities:

- Existing onsite sewage disposal evaluation
- Disposal system improvements
- Inspection and maintenance
- Community disposal system installations
- Water quality monitoring, and
- Nitrate Management Plan implementation

**TMDL Implementation Tracking and Progress:**

The reporting mechanisms identified in the TMDL include the Wastewater Management Plan status reports (every three years starting 2/2002) and the Five Year Report on Nitrate Management Plan Implementation (every five years starting 2/2002) to be submitted by the County of Santa Cruz (County). The TMDL identifies information to be submitted, such as nitrate data and loading analyses and implementation status, in order to evaluate TMDL progress.

During FY 04-05, Regional Board staff reviewed progress towards implementing the Nitrate TMDL by reviewing data and implementation status. In Fall 2004, staff reviewed the Wastewater Management Plan status report submitted in May, 2003 for the 1999-2001 period. Staff determined that while it appears that progress was being made towards implementation, additional information needed to be included in the status report to document the level of progress that is being made towards achieving the TMDL. In January, 2005 staff submitted comments to the County requesting additional information (percent of nitrate reductions since 1995 and 2003, current relative contributions, detailed status of implementation) be included in

the next status report in order to determine the level of progress that is being made towards implementing the TMDL. County staff submitted information on June 8, 2005. This information is contained in its entirety in Attachment A, SAN LORENZO WASTEWATER MANAGEMENT PLAN, PROGRAM STATUS REPORT, 2002-2004, Sections Regarding Nitrate Management. Attachment A includes County staff's analysis of nitrate concentrations and loads through 2004. The following conclusions are taken from this report:

- Year-round nitrate concentrations are decreasing at a rate of about 23% over ten years.
- Summer nitrate levels tend to be more stable; those are also the levels that affect growth of algae and creation of taste and odor problems in the drinking water supply that is derived from the San Lorenzo River.
- Summer nitrate concentrations were more elevated during dry years. There has been a general decreasing trend since the mid 1990s until 2003 and 2004, when nitrate concentrations increased significantly during late summer as the flows declined below median levels.
- Summer nitrate loads at Big Trees shows almost an opposite trend of increasing loads with more recent wet years.
- Nitrate concentrations are lower, but loads are higher in most of the watershed in the more recent time period. This is consistent with the wetter conditions that prevailed after the nitrate management plan was completed. The one exception is Boulder Creek, where both concentrations and loads are down, further indicating the effectiveness of the wastewater plant upgrades in reducing nitrogen discharge in that watershed.
- Nitrate concentrations are quite low at Lompico Creek, but continue to be elevated at Carbonera, and particularly Shingle Mill Creek.
- The City of Santa Cruz has not reported in significant episodes of taste and odor problems in the River in recent years. This would be consistent with the generally declining nitrate concentrations.
- No other adverse impacts attributable to elevated nitrate have been noted.
- Observations of nitrate trends suggest that reductions are occurring, but more monitoring over both wet and dry years are needed to confirm findings.

Attachment A also includes a brief summary and a detailed status of nitrate management implementation measures since TMDL adoption. Ongoing activities include the following:

- Manage Wastewater Disposal for Nitrogen Reduction
- Livestock Management for Nitrogen Reduction
- Land Use Regulations for Nitrogen Reduction
- Ongoing Monitoring of Nitrogen Sources

**Conclusions and Recommendations**

As discussed, implementation was projected to provide for a 15-20% reduction in nitrate levels over 10 years following TMDL adoption, with a further reduction of 10% in the next 10 years. Additionally, the TMDL identifies the maximum pollutant contributions allowed to attain water quality standards and specifies a target attainment year of 2005 for nitrate levels to be reduced by 15%. The targets specified for 2005 are as follows:

| Station | 2005 Target (lbs/summer*) |
|---|---|
| San Lorenzo River at Big Trees (Felton) | 12,390 |
| Shingle Mill Creek @ San Lorenzo River | 995 |
| Carbonero Creek @ Brantiforte Creek | 230 |

**summer is defined as the period between July 1 and September 30.*

Regional Board staff reviewed data analyses (through 2004 data) and status information submitted by the County. Implementation actions identified in the TMDL are being carried out and efforts continue. Year-round nitrate loads are decreasing; however, as of 2004, it does not appear that summer loads will reach targets levels identified for 2005. Staff recommends re-evaluating implementation actions if in seven years following TMDL adoption (January, 2010), summer nitrate loads have not declined by at least 15%.

In order to most efficiently and effectively evaluate TMDL compliance and progress, Regional Board staff identified key summary analyses, along with other reporting information specified in the TMDL, to be included in information submitted to the Regional Board. This summary information is as follows:

- percent of nitrate reductions since TMDL adoption per the numeric targets and attainment years identified in the TMDL,
- average nitrate concentrations and loading during July 1$^{st}$ –September 30$^{th}$ annually at each monitoring site,
- annual year-round concentrations and loads,
- current relative contributions from sources identified in the TMDL, and
- a detailed status of nitrate management implementation measures implemented since the last reporting cycle (through 2004).

Questions about this project, its progress, conclusions presented in this Progress Report, or anticipated future work planned or scheduled for this project should be addressed to Katie McNeill at the Regional Board. She may be contacted by telephone at: (805)- 549 - 3336, or by e-mail at: kmcneill@waterboards.ca.gov.

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# SAN LORENZO WASTEWATER MANAGEMENT PLAN PROGRAM STATUS REPORT, 2002-2004

## Sections Regarding Nitrate Management

## Summary of Water Quality Issues in San Lorenzo Watershed

Nitrate and pathogens are the two water quality parameters in the San Lorenzo Watershed that can be affected by wastewater disposal, among other sources.

### Nitrate

Nitrate levels in the River were estimated to be 5-7 times above natural background levels as a result of human settlement and other activities in the Watershed (SCCHSA, 1995). At about 0.4 mg-N/l, nitrate levels in the River are well below the safe drinking water standard of 10 mg-N/l. However, nitrate is the limiting nutrient in the River and increased nitrate levels can stimulate biological growth of algae, molds, fungi, and other organisms. This increased biological activity may threaten drinking water supply by releasing organic compounds, which cause noxious tastes and odors and produce potentially carcinogenic disinfection byproducts when the water is treated. In the past localized concentrations of nitrate in groundwater had at times threatened to violate the drinking water standard in areas of Ben Lomond, Boulder Creek, and Scotts Valley.

The San Lorenzo Nitrate Management Plan (SCCHSA, 1995) determined that an estimated 84% of the current nitrate load in the River results from human activities in the watershed. Calculations of relative contributions to present summer nitrate levels in the lower River (at Felton) are as follows:

| | |
|---|---|
| - Septic Systems in sandy areas | 38% |
| - Septic Systems in non-sandy areas | 19% |
| - Natural sources in sandy areas | 12% |
| - Sewer discharge from B.C. Country Club | 10% |
| - Scotts Valley nitrate plume | 9% |
| - Livestock and stables | 6% |
| - Natural sources in non-sandy areas | 4% |
| - Landscaping/fertilizer use | 2% |

Approximately 67% of the nitrate in the River during the summer periods that the study was conducted came from areas underlain by sandy soils of the Santa Margarita Sandstone. A septic system in sandy soils contributes 10-15 times as much nitrate to the River as a septic system in less permeable soils. Nitrogen reduction efforts are most needed and will be most effective in areas with sandy areas.

In some parts of the country, harvesting of timber can cause significant release of nitrate

to streams. Several monitoring efforts in the San Lorenzo Watershed have indicated that timber harvests are not a significant source of nitrate in this area. This is likely due to several factors: the relatively small extent of individual harvests, harvests are not clear-cuts, forest soils in the San Lorenzo Watershed tend to be more clay-rich and hold onto nitrate, and the other sources of nitrate in San Lorenzo tend to be much more significant than any contribution from timber harvests.

## Nitrate Trends

Nitrate trends are measured in terms of nitrate concentration and nitrate load, which is a product of the concentration and the stream discharge. Nitrate concentrations tend to fluctuate significantly with the season and with the amount of flow. Except for runoff periods, nitrate concentrations tend to be higher with lower flows and less dilution. Loading fluctuates even more and is very sensitive to the amount of flow. These variations make determining trends in nitrate levels challenging. The ultimate objective is to reduce or control nitrate concentrations as the relative availability of nitrate for uptake in the stream ecosystem is the factor that impacts beneficial uses. Long term reductions in concentrations require long term reductions in nitrate loads.Figure 1 shows nitrate concentrations over time in the San Lorenzo River at Big Trees.

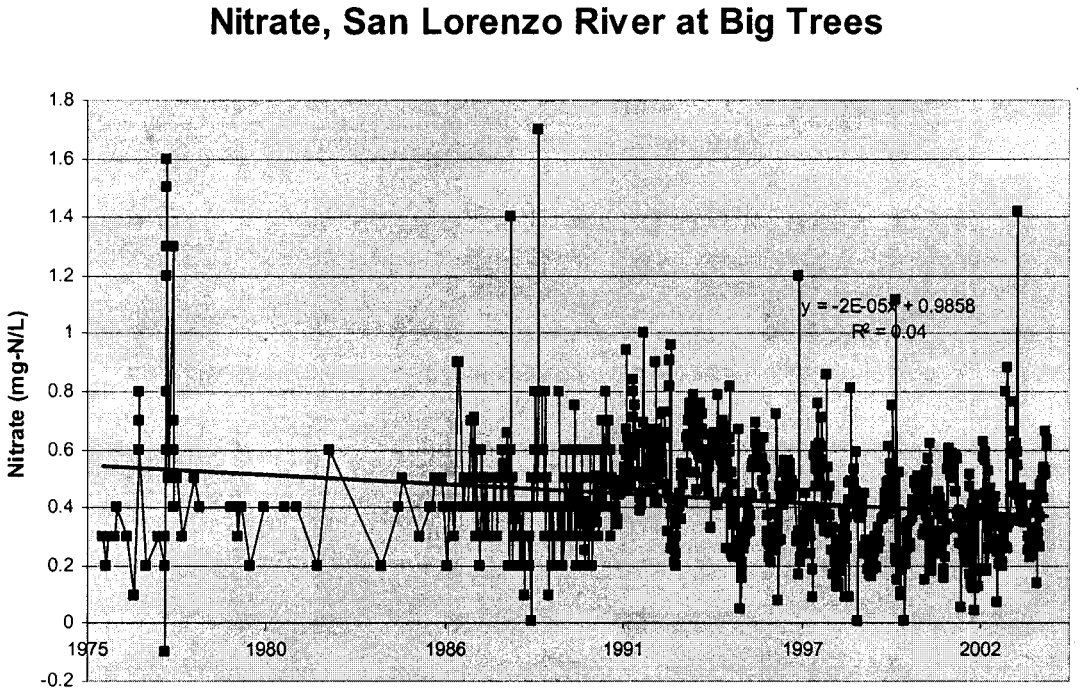
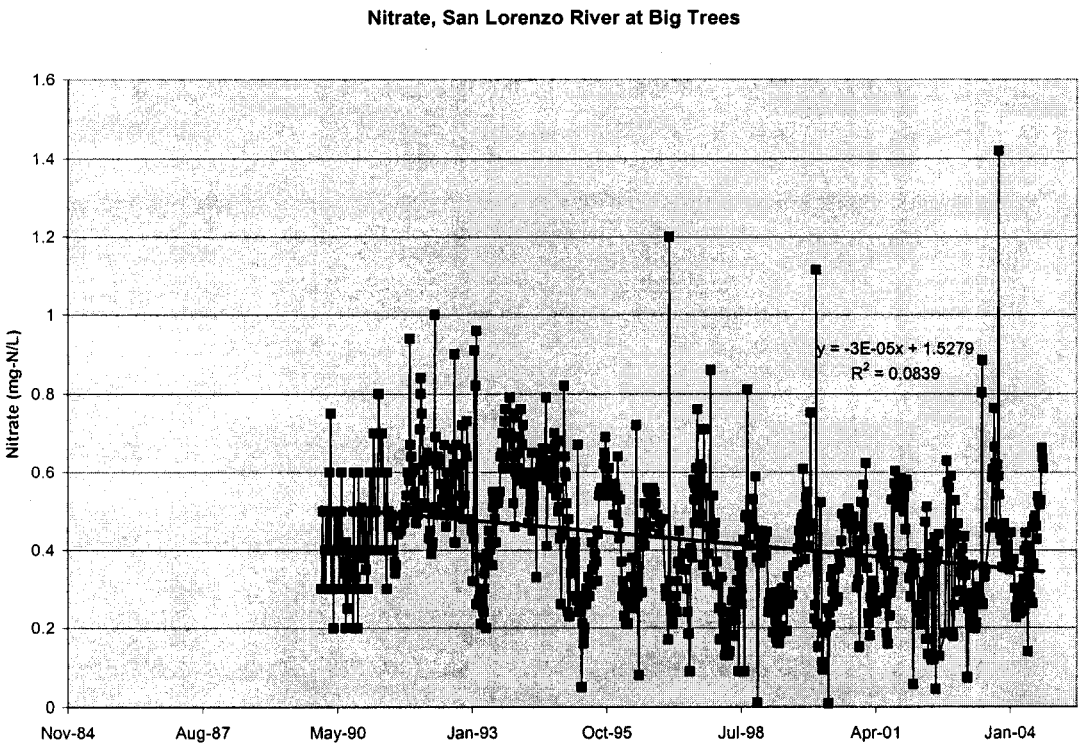
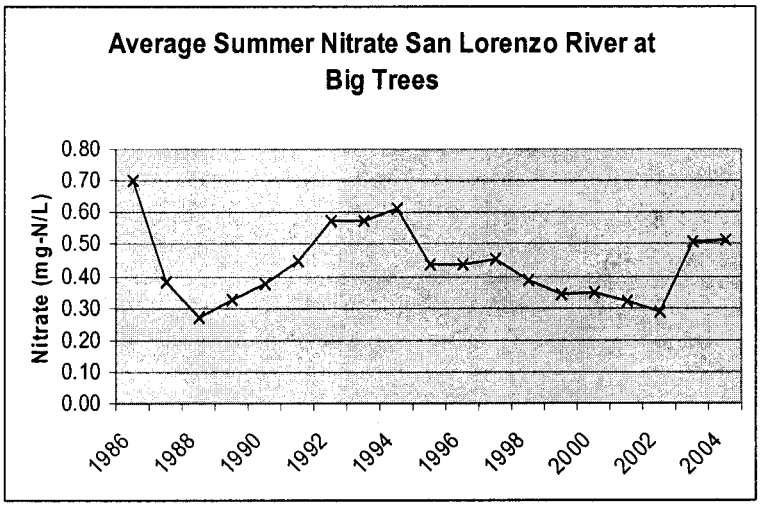



Figure 2 focuses on the more recent period since the County began implementing the San Lorenzo Wastewater Management Program in 1986. Although the correlation coefficient of the trend line is low, the trend in nitrate concentration is decreasing at a rate of about 23% over ten years.

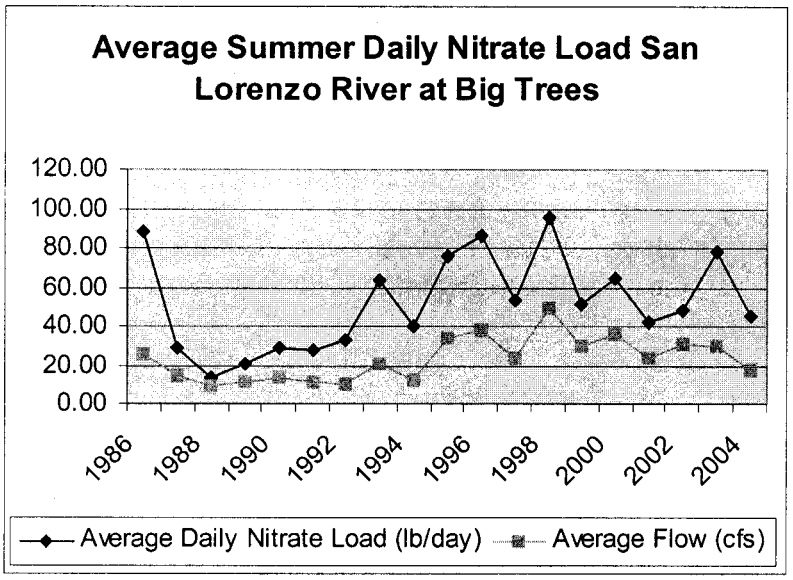



Both the San Lorenzo Nitrate Management Plan and the Nitrate TMDL focus on summer nitrate levels. Those levels tend to be more stable and those are also the levels that affect growth of algae and creation of taste and odor problems in the drinking water supply that is derived from the San Lorenzo River. For aggregating summer water quality data, a flexible time period is assigned that is based on flow regimes, water temperatures, timing of spring rainfall and timing of fall rainfall. Generally summer begins in June and end in September or early October. Following is a chart of summer nitrate levels at Big Trees.




Summer nitrate concentrations were more elevated during dry years. There has been a general decreasing trend since the mid 1990s until 2003 and 2004, when nitrate concentrations increased significantly during late summer as the flows declined below

median levels. A chart of summer nitrate loads at Big Trees shows almost an opposite trend of increasing loads with more recent wet years.

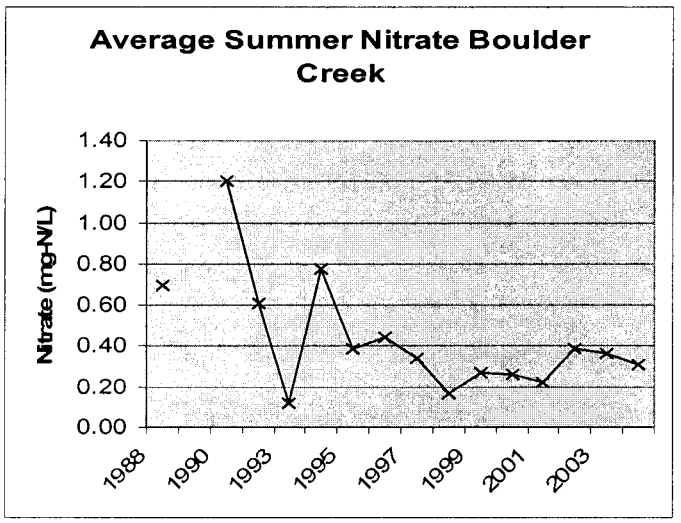



The following tables show average summer nitrate concentrations and loads from various stations in the San Lorenzo Watershed during the past 19 years. The loading calculations are not as precise as those presented in the nitrate management plan, as most stations had only 2-3 flow measurements during the summer periods.

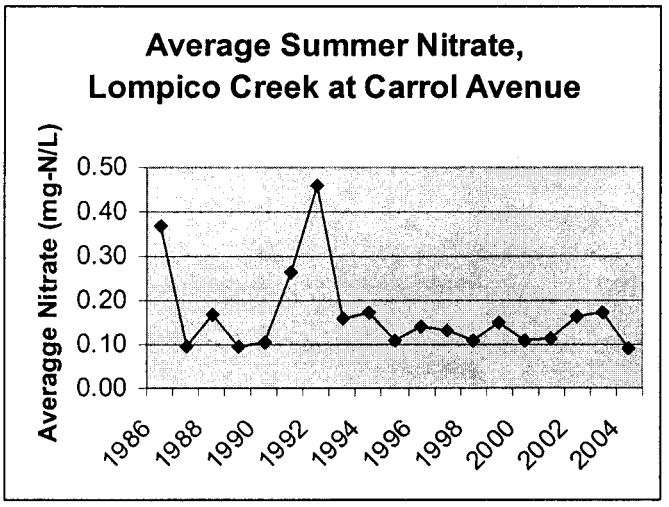
The tables generally show that nitrate concentrations are lower, but loads are higher in most of the watershed in the more recent time period. This is consistent with the wetter conditions that prevailed after the nitrate management plan was completed. The one exception is Boulder Creek, where both concentrations and loads are down, further indicating the effectiveness of the wastewater plant upgrades in reducing nitrogen discharge in that watershed.

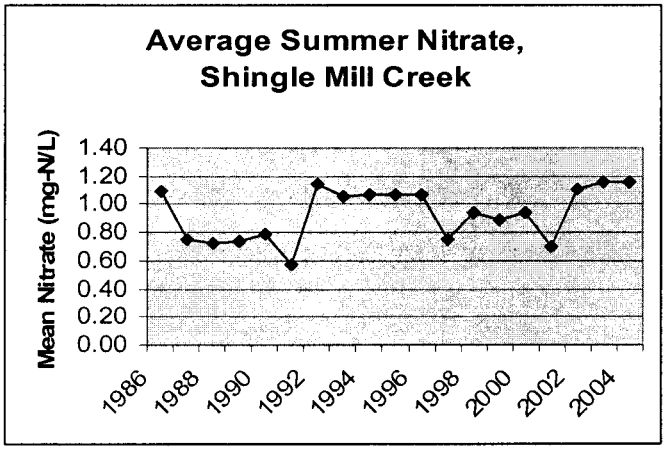
| | | Summary of Summer Data from 1986-2004 | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Station Number | Location | Years of Record | Number of Flow Measure-ments | Average Flow (cfs) | Number of Nitrate Samples | Average Nitrate (mg-N/L) | Average Nitrate Load (lb-N/day) | Percent of Big Trees Load |
| 0110 | Carbonera Cr. | 10 | 12 | 0.91 | 13 | 0.59 | 3.1 | 6.1% |
| 022 | SLR at Sycamore Grove | 19 | 32 | 23.41 | 203 | 0.27 | 34.6 | 67.0% |
| 050 | Shingle Mill Creek at SLR | 19 | 25 | 0.32 | 58 | 0.93 | 1.9 | 3.6% |
| 060 | **SLR at Big Trees** | 19 | 260 | 23.14 | 282 | 0.44 | **51.7** | 100.0% |
| 070 | Zayante at SLR | 19 | 41 | 6.37 | 70 | 0.59 | 22.0 | 42.5% |
| 071 | Bean Creek at Zayante | 14 | 19 | 2.97 | 20 | 0.57 | 9.3 | 17.9% |
| 07106 | Bean Cr. At Mt. Hermon Rd | 16 | 34 | 2.37 | 36 | 0.48 | 6.3 | 12.2% |
| 07528 | Lompico Cr. at Carrol Ave. | 19 | 26 | 0.31 | 53 | 0.17 | 0.2 | 0.5% |
| 140 | SLR at Mt Cross | 19 | 31 | 11.83 | 44 | 0.54 | 32.0 | 61.9% |
| 150 | Newell Cr at SLR | 19 | 33 | 1.99 | 64 | 0.88 | 12.0 | 23.2% |
| 250 | Boulder Cr. at SLR | 15 | 26 | 2.66 | 45 | 0.44 | 4.7 | 9.2% |
| 2560 | Boulder Cr. at Bracken Brae | 10 | 13 | 1.30 | 13 | 0.69 | 3.0 | 5.8% |

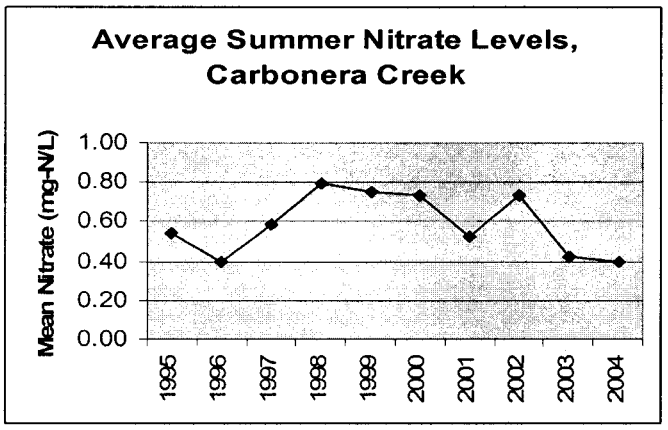
| | | Nitrate Management Plan (1990-93) | | |
|---|---|---|---|---|
| Station Number | Location | Average Nitrate (mg-N/L) | Estimated Load from Nitrate Mgt.Plan (lb-N/day) | Percent of Big Trees Load |
| 0110 | Carbonera Cr. | - | - | - |
| 022 | SLR at Sycamore Grove | 0.33 | 19 | 52.8% |
| 050 | Shingle Mill Creek at SLR | - | - | - |
| 060 | **SLR at Big Trees** | 0.48 | **36** | 100.0% |
| 070 | Zayante at SLR | 0.58 | 13 | 36.1% |
| 071 | Bean Creek at Zayante | 0.65 | 9 | 25.0% |
| 07106 | Bean Cr. At Mt. Hermon Rd | 0.57 | - | - |
| 07528 | Lompico Cr. at Carrol Ave. | - | - | - |
| 140 | SLR at Mt Cross | 0.58 | 21 | 58.3% |
| 150 | Newell Cr at SLR | 0.87 | 6 | 16.7% |
| 250 | Boulder Cr. at SLR | 0.94 | 6 | 16.7% |
| 2560 | Boulder Cr. at Bracken Brae | 1.38 | 4.3 | 11.9% |

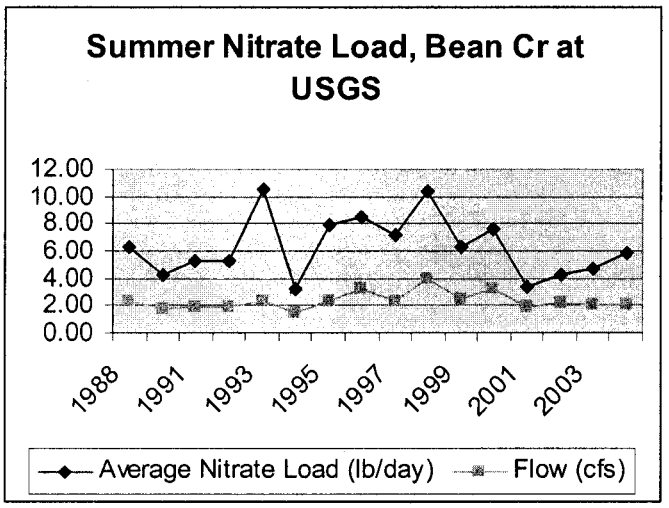


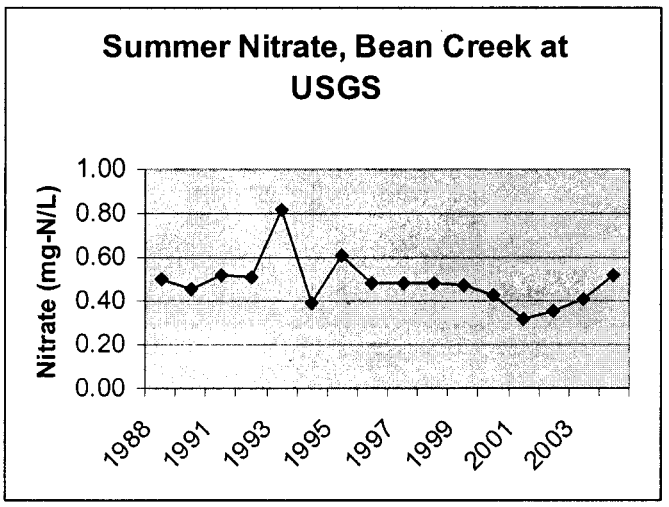

The nitrate TMDL for the San Lorenzo Watershed also targets Lompico Creek, Shingle Mill Creek and Carbonera Creek. Following are plots of average summer nitrate concentrations for those locations. Nitrate concentrations are quite low at Lompico Creek, but continue to be elevated at Carbonera, and particularly Shingle Mill Creeks.






The City of Santa Cruz has not reported in significant episodes of taste and odor problems in the River in recent years. This would be consistent with the generally declining nitrate concentrations. No other adverse impacts attributable to elevated nitrate have been noted.

The San Lorenzo Valley Water District utilizes groundwater from the Quail Hollow Groundwater Basin, which discharges to Newell Creek and the River above Mt. Cross. The district analyzes for nitrate in its wells every two years during the summer. Nitrate levels at Quail Hollow Well 4A were 0.47 and .064 mg-N/L in August 2002 and July 2004, respectively. Concentration in Quail Hollow Well 5A were 1.96 and 2.67 mg-N/L in 2002 and 2004. The levels in QH 5A are comparable to levels found when the nitrate management plan was being prepared in 1986-1993.

## San Lorenzo Nitrate Management Plan and Nitrate TMDL

The San Lorenzo Nitrate Management Plan was developed to address all major sources of elevated nitrate in the River. A grant was obtained under Section 205j of the Clean Water Act to investigate the impacts of nitrate on algae growth and water supply, to determine the primary sources of nitrate in the watershed, and to evaluate various alternatives for nitrate reduction. The Plan includes a watershed nitrate budget, which was used to calculate resulting nitrate levels in the River under different scenarios. The adopted Plan represented a balance between cost and available technology and the need to reduce nitrate levels by a moderate amount in order to reduce potential threats to drinking water quality and recreation. The San Lorenzo Nitrate Management Plan was adopted by the County and State in 1995. The Plan findings and recommendations also formed the basis for the Nitrate TMDL (Total Maximum Daily Load Plan) that was adopted by the Central Coast Regional Water Quality Control Board in 2003.

The recommended nitrate management plan provides for implementing the most cost-effective measures to achieve the desired level of nitrate reduction. The plan provides for limiting increased nitrate release from new or expanded development in sandy soils, and gradually reducing nitrate discharge from existing sources as public and private funds become available and reduction technology improves. Implementation of the recommended policies was projected to provide for a 15-20% reduction in current nitrate levels over the next 10 years, with a further reduction of 10% in the following 10 years. Observations of nitrate trends as discussed above, suggest that these reductions are occurring, but more monitoring over both wet and dry years will be needed to confirm that.

Following is a brief summary of the nitrate management measures that were included in the nitrate management plan, and the status of implementation:

### Manage Wastewater Disposal for Nitrogen Reduction

1. Maintain the existing requirement of a one acre minimum parcel size for new development served by septic systems in the San Lorenzo Watershed (Ongoing)

2. Implement improved wastewater disposal management through the San Lorenzo Wastewater Management Plan (Ongoing).

3. Complete ongoing efforts to improve treatment procedures at Boulder Creek Country Club Treatment Plant to reduce nitrate discharge by using wastewater reclamation on the golf course. (The treatment process was then refined and fully operational by May 1998. The improvements provide for wastewater reclamation on the golf course much of the year, with treatment for nitrogen removal at other times. Effluent has generally not been used for reclamation on the golf course, due to strict regulations. However, the effluent that is delivered to leachfields for disposal has significantly lower nitrogen levels. Nitrogen levels in Boulder Creek are much reduced from the mid 1990's. )

4. Maintain the new requirement for shallow leachfields for new and repaired septic systems (less than 4 feet in sandy areas, and 4-6.5 feet in other areas). (Ongoing)

5. Implement enhanced technology for at least 50% nitrogen removal for septic system in sandy soils:
   a. Require septic systems serving new or expanded uses in sandy soils to install enhanced treatment measures which will reduce nitrogen discharge by at least 50%. (Implemented August, 1995; existing systems to be upgraded at the time of major remodels (projected rate of 1.2% (20 systems) per year).)
   b. Encourage the use of nitrogen removal methods for any onsite disposal system which will use a nonstandard system. (Since 1995, 245 alternative systems with capability for nitrogen removal have been approved for use in the San Lorenzo Watershed: 15 sand filters, 63 Advantex Systems, and 167 FAST systems)
   c. Continue to evaluate new onsite wastewater disposal technology for nitrogen reduction to identify more cost-effective measures. Require higher levels of nitrogen removal if measures become available that are more cost-effective than sand filters.
   d. Apply for State revolving funds and other funds to develop a funding source to assist property owners in repairing their systems to provide enhanced treatment. (Revised program is now being implemented, beginning June 2005. This will fund 100 upgrades over the next five years.)
   e. When more cost-effective technology and/or funding assistance becomes available, require all onsite system repairs in sandy areas to utilize enhanced treatment for nitrogen removal. (Implementation deferred, pending more inexpensive technology and documented need for further nitrogen reduction.)

6. Require all large onsite disposal systems which serve more than 5 residential units or dispose more than an average of 2000 gallons per day to utilize enhanced treatment to reduce nitrate discharge by at least 50%. Installation of such measures for existing systems shall be required at the time of system repair or upgrade. (Estimated 1-2 upgrades involving approximately 5000 gallons per day per year.)

7. Require all new or revised waste discharge permits and all new development projects in the San Lorenzo Watershed to include nitrogen control measures consistent with this Nitrate Management Plan. (County staff has worked with staff at the Regional Board to include nitrogen reduction requirements in new or amended waste discharge

permits. This was included in the permits for expansion of the Mount Hermon Association system, the Boulder Creek Country Club system, the San Lorenzo Valley High School system, Brookdale Lodge, Pasatiempo Inn, and Bear Creek Estates.)

## Livestock Management for Nitrogen Reduction

8. Continue to work with stable owners and develop a new ordinance requiring practices to reduce nitrate discharge: cover manure piles, maintain manure piles and paddock areas at least 50-100 ft from streams or drainageways, direct drainage away from paddock areas, and provide other measures as necessary to reduce discharge of nitrate, sediment, and contaminants. (Ongoing, after meetings with stable and horse owners, it was decided to pursue an approach of education, technical assistance, and voluntary compliance. A grant funded effort by the Resource Conservation District got underway in 2001 and was completed in early 2003, with 3 pilot projects implemented in the watershed, as well as significant outreach to the Horsemen's Association and horse owners. All new or modified horse operations now prepare and implement manure management plans)

## Land Use Regulations for Nitrogen Reduction

9. Maintain current density restrictions requiring 10 acres per parcel for new land divisions and other protective measures for groundwater recharge areas. (Ongoing)

10. Maintain current regulations on erosion control, land clearing, and riparian corridor protection. (Ongoing)

11. Do not approve new land use projects within the San Lorenzo Watershed which will increase the discharge of nitrate to groundwater or surface water by more than 15 pounds of nitrogen per acre per year from the project area. (Ongoing, a proposal to construct playing fields in the Quail Hollow area was not approved partly due to concerns over discharge of fertilizers and other chemicals.)

## Ongoing Monitoring of Nitrogen Sources

12. Monitor the Scotts Valley nitrate plume, and identify potential ongoing sources of nitrate. Work with the City of Scotts Valley and property owners for reduction of nitrate discharge from Scotts Valley, if feasible. (Ongoing monitoring, nitrate concentrations seems to be diminishing).

13. Continue to monitor nitrate levels in surface and groundwater. Reevaluate implementation of more stringent control measures if summer nitrate levels in the River have not declined by at least 15% by 2010. (Ongoing monitoring, reevaluation in 2010).